

New, Emerging, and Threatening Plant Diseases and Crop Biosecurity ¹

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Figure 1. Southern Plant Diagnostic Network (SPDN)
"Educate to detect"

SPDN: Regional Network for Crop Biosecurity

UF/IFAS received a major USDA grant award in 2002-2007 to help protect agriculture as part of the USDA Homeland Security initiative by quickly detecting and accurately diagnosing and identifying new introductions of pathogens, insects, nematodes, and weeds.

Five land grant universities (University of California at Davis, Cornell University, University of Florida, Kansas State University, and Michigan State

University) in the United States have been designated as the coordinating institutions for their Plant Diagnostic Regions for the U.S. National Plant Diagnostic Network. The **Southern Plant Diagnostic Network (SPDN)** (<http://spdn.ifas.ufl.edu>) at the University of Florida (UF) coordinated by IFAS and established this network with 11 other southern states and two U.S. territories (Alabama, Arkansas, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, Puerto Rico, South Carolina, Tennessee, Texas, U.S. Virgin Islands, Virginia -see Figure 1). This network's main objective is to improve regional capabilities for rapid and accurate identification and diagnoses to safeguard against newly introduced and re-emerging pests and pathogens, genetically modified pathogens, pesticide-resistant pathogens, and natural changes in endemic organisms.

The mission of SPDN as a regional network is to promote the health and security of plants by intercepting and preventing plant diseases and pests that could threaten U.S. agriculture. In response to national concerns for bioterrorist activities that can affect our crop and food supply, the Diagnostic

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Networks are accomplishing their missions by working with partners throughout the U.S. to (i) enhance diagnostic capabilities and establish a secure, regional network for the detection and diagnosis of plant health problems, and better track the health of crops and/or the spread of pests, (ii) extend and support sound public policies, implement rapid and accurate diagnoses, and (iii) provide leadership and training.

New plant diseases caused by fungal, bacterial and viral pathogens have appeared at an alarming rate in Florida in the last two decades (Harmon, C. L., Harmon, P. F., and Momol, M. T. 2006. Florida: A Sentinel State for New and Emerging Plant Pathogens. *Pytopathology* 96:546). Plant pathologists have described those findings in scientific journals, and the media has shown great interest in this issue. Citrus diseases such as canker and greening in Florida, for example, have been a highly visible disease problems discussed, sometimes daily, in the popular media. Legitimate concerns on citrus canker raised by citrus growers in Florida received immediate attention by all state and federal agricultural organizations. The eradication efforts of FDACS in collaboration with scientists from UF/IFAS and USDA, have been aimed at limiting and recovering from serious disease and pest introductions.

In light of national concerns for crop biosecurity, new, emerging and threatening plant diseases have received more attention from all interested parties. Geographically, the state of Florida is uniquely at risk for the introduction of new pathogens and pests of plants and animals, and the climate is highly conducive to maintaining disease-inducing organisms year-round. Due to its location, heavy visitor traffic and climate, Florida has experienced at least 4-5 new plant diseases per year. UF/IFAS Plant Disease Clinics and plant pathologists in Florida actively assist the agricultural industry in Florida and the US by rapid and accurate detection, diagnosis, and development of management recommendations for these new diseases.

Disease Categories

The American Phytopathological Society (APS) is taking a leadership role in the US to increase awareness of crop biosecurity issues. In an *APSnet* feature article, Damsteegt (1999) described five pathogen categories. We are suggesting a similar approach:

1. *New Disease*. Disease described on a new host within last five years in a new geographic area.
2. *Emerging Disease*. Disease incidence has increased within the last 10-15 years.
3. *Re-emerging Disease*. Previously known disease in an area, but gaining importance due to pesticide resistance, vector shift, changes in cultivars or culture, or natural changes in endemic pathogens, and other reasons.
4. *Threatening Disease*. Disease not reported or very limited in distribution in a new geographic area.
5. *Chronic/spreading Disease*. Known for a longer period in an area but still causing out breaks.

Lists of new and emerging diseases in Florida (Table 1) and elsewhere have been developed. See these Web sites :

1. NCSU site:
<http://craven.ces.ncsu.edu/files/library/25/hortnews506.pdf>
2. Damsteegt (1999) APS site:
<http://www.apsnet.org/online/feature/NewViruses/Top.html>
3. Madden (2001) APS site:
<http://www.apsnet.org/online/feature/exotic/>

Crop Biosecurity

Literature on crop biosecurity and biological warfare (BW) related to plant pathogens is limited. An *APSnet* feature article by Schaad et al. (1999) summarized the subject and presented references. Schaad et al. (1999) mentioned the difficulties of determining precise causes for the emergence of new diseases, and added “the remote possibility that

some new diseases could have occurred as a result of deliberate introduction.”

For further information please visit these web pages:

<http://www.apsnet.org/online/feature/NewViruses/Top.html>

<http://www.apsnet.org/online/feature/BioSecurity/Top.html>

Plant pathologists and personnel in plant disease clinics, county extension offices and private sector are the first line of defense against new diseases. In the state of Florida the four official plant disease clinics, many plant pathologists at several RECs, and 67 county extension offices are networked against a potential threat from introduced plant pathogens. FPDN (<http://fpdn.ifas.ufl.edu/index.htm>), UF/IFAS's Web-based Distance Diagnostic and Identification System (DDIS - <http://ddis.ifas.ufl.edu>) and PDIS (<http://www.pdis.org/>) are playing an important role in the accomplishment of this goal. Improvement in the infrastructure of plant disease clinics and the DDIS capabilities of county extension offices is essential for defense against new diseases.

Scientists at UF/IFAS, USDA, and FDACS are providing research support for discoveries, rapid detection, and identification of plant pathogens. For a more secure future of Florida's crop and food supply, research in epidemiology, molecular biology, and in all disciplines of plant pathology needs further enhancement. Whether BW-related or not, this investment is still needed to maintain the competitiveness of Florida's agricultural sector. Specific areas that need further research are the following:

- molecular detection methods, PCR, realtime PCR
- epidemiology and management of new and exotic plant diseases
- molecular fingerprinting techniques
- development of disease resistant genotypes through classical breeding and genetic engineering

- enhanced distance diagnostics, machine vision, and electronic nose technologies

County Extension Faculty (First Detector Educators) and First Detectors - backbone of the FPDN

If you encounter an unfamiliar disease symptom on any plant, immediately send samples to the closest plant disease clinic or plant pathologist. You may also take digital images of the symptoms and send them to multiple plant pathology specialists through DDIS. Diagnostic fees may not be charged for samples associated with crop biosecurity and new diseases in Florida. Prepare newsletter and media articles on the subject of crop biosecurity to increase awareness among your clientele and Florida citizens. For further information, or in an emergency situation, contact one of the plant disease clinics and offices listed below.

Gainesville: Florida Extension Plant Disease Clinic. P.O. Box 110830, U.F., Bldg. 78, Mowry Rd., University of Florida, Gainesville, FL 32611-0830. **Note:** For overnight mail or package delivery service (UPS, Fedex, etc.) be sure to include the physical street address: "UF, Bldg. 78, Mowry Rd." Phone: **(352) 392-1795** or Suncom 622-1795, FAX: (352) 392-3438, E-mail: pdca@ufl.edu

Quincy: Florida Extension Plant Diagnostic Clinic-Quincy. North Florida REC, 155 Research Road, Quincy, FL 32351. **Phone: (850)-875-7140** or Suncom 294-7140, FAX (850) 875-7148, E-mail: tmomol@ufl.edu

Immokalee: Florida Extension Plant Disease Clinic-Immokalee. Southwest Florida REC, 2686 SR 29 North, Immokalee, FL 34142, **Phone: (239) 658-3432** or Suncom 975-3400, FAX (941) 658-3469, E-mail: pdr@ufl.edu

Homestead: Florida Extension Plant Disease Clinic-Homestead. Tropical REC, 18905 S.W. 280th St., Homestead, FL 33031-3314. **Phone: (305) 246-6340** or Suncom 478-6340, FAX (305) 246-7003, E-mail: ajp@ufl.edu

Wimauma: Florida Extension Plant Disease Clinic-Wimauma. Gulf Coast REC, 14625 CR 672,

Wimauma, FL 33598. **Phone: (813) 634-0000** or
Suncom 514-6890, FAX (813) 634-0001, E-mail:
nperes@ufl.edu

SPDN Director: Bob McGovern, Plant
Pathology, 1453 Fifield Hall, P.O. Box 110680,
Gainesville , FL 32611-0680. **Phone (352) 392-3631**
ext 213 or Suncom 622-3631 ext 213, FAX (352)
392-7348, E-mail: rjm@ufl.edu

Contacts in the Southern Region and U.S. for University Plant Diagnostic Clinics

American Phytopathological Society Web site:
[http://www.apsnet.org/directories/
univ_diagnosticians.asp](http://www.apsnet.org/directories/univ_diagnosticians.asp)

Table 1. List of important new and emerging diseases in Florida. This is a dynamic list and subject to change in t

Disease	Pathogen	Major Hosts	Internet Source
Bacterial Fruit Blotch	<i>Acidovorax avenae</i> subsp. <i>citrulli</i>	Watermelon	http://www.doacs.state.fl.us/pi/enpp/pathology/fruit-blotch.html
Citrus Canker	<i>Xanthomonas axonopodis</i> pv. <i>citri</i>	Citrus spp.	http://www.doacs.state.fl.us/pi/canker/pdf/cankerflorida.pdf
Daylily Rust	<i>Puccinia hemerocallidis</i>	Daylily	http://www.doacs.state.fl.us/pi/enpp/pathology/daylily-rust.html
Tomato Yellow leaf curl (TYLC)	TYLCV (new strains or New Begomoviruses)	Tomato Ornamentals	http://edis.ifas.ufl.edu/NFREC1 http://www.doacs.state.fl.us/pi/enpp/pathology/pathcirc/pp366.pdf
Tomato spotted wilt (TSW)	TSWV (new strains) New Tospoviruses	Tomato Peanut Tobacco Potato Pepper	http://plantpath.ifas.ufl.edu/takextpub/FactSheets/circ0914.pdf http://thrips.ifas.ufl.edu/ http://www.oznet.ksu.edu/tospovirus/
Impatiens necrotic spot (INS)	INSV	Ornamentals	http://www.oznet.ksu.edu/tospovirus/
Bacterial Wilt	<i>Ralstonia solanacearum</i> especially race 3	Tomato Potato Tobacco Geranium Ornamentals	http://plantpath.ifas.ufl.edu/takextpub/FactSheets/circ1207.pdf http://edis.ifas.ufl.edu/PP103
Karnal Bunt	<i>Tilletia indica</i>	Wheat	http://www.aphis.usda.gov/ppq/ep/kb/
Bacterial streak & bulb rot of onion, sourskin of onion, slippery skin of onion, Pantoea blight of onion, and Erwinia and Pseudomonas soft rots of onion.	http://www.apsnet.org/online/common/names/onion.asp	Onion	http://www.plant.uga.edu/faculty/gitaitis.htm
Chrysanthemum White rust	<i>Puccinia horiana</i>	Chrysanthemum	http://spdn.ifas.ufl.edu/Top_Exotic_Pathogens_of_Concern_SPDN.pdf
Citrus variegation	Citrus variegation ilarvirus (CVC)	Citrus	http://image.fs.uidaho.edu/vidе/descr223.htm#Nomenclature
Citrus Greening	<i>Liberobacter</i> spp.	Citrus	http://spdn.ifas.ufl.edu/Top_Exotic_Pathogens_of_Concern_SPDN.pdf
Pierce's Disease	<i>Xylella fastidiosa</i>	Grape, ornamentals, and more	http://www.cnr.berkeley.edu/xylella/
Potato Cyst Nematode	<i>Globodera pallida</i>	Potato family, including tomato, eggplant, and some weeds	http://www.aphis.usda.gov/newsroom/content/2006/06/pcnematode.shtml http://www.aphis.usda.gov/ppq/ispmp/potato/pcn.html
Plum Pox	Plum pox virus (PPV)	Stone fruits	http://sharka.cas.psu.edu/ http://www.aphis.usda.gov/ppq/ep/plumpox/index.html

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Potato mop-top	Potato mop-top virus (PMTV)	Potato	http://plant-disease.ippc.orst.edu/disease.cfm?RecordID=1439
Soybean Rust	<i>Phakopsora</i> spp.	Soybean	http://www.aphis.usda.gov/ppq/ep/soybean_rust/detection5.html